Geography (H), UG, 4th Semester

CC-10-TH: FIELD WORK AND RESEARCH METHODOLOGY

Topic: Hypothesis

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What is Hypothesis?

A set of assumption to be proved or disproved is called **hypothesis.**

For researcher hypothesis is a formal question that he intends to resolve.

Hypothesis is considered as an intelligent guess or prediction that gives directional to the researcher to answer the research question.

Hypothesis or Hypotheses are defined as the predictive statement or explanation, capable of being tested by scientific methods that show the relationship between two or more independent to some dependent variables in a specified population.

A hypothesis is an assumption about relations between variables. It is a tentative explanation of the research problem or a guess about the research outcome.

Webster (1968) has defined hypothesis as *"a tentative assumption made in order to draw out and test its logical or empirical consequences.*" 'Test' here means "either to prove it wrong or to confirm it".

Few Examples of Hypothesis

- Group study increases higher division achievement.
- Young girls (between 15-30 years) are more victims of crimes against women than middle –aged women (between 30-40 years).
- Educated women have more adjustment problems after marriage than illiterate women.
- Economic instability hampers development of an establishment.
- Job satisfaction decreases as working hours increases.

Criteria for Hypothesis construction

Hypothesis is never formulated in the form of question. Bailey(1982), Becker(1989), Selltiz et al (1976), and Sarantakos (1998) have pointed out a number of standerds to be met in formulating a hypothesis:

1. It should be empirically testable, whether it is write or wrong.
2. It should be specific and precise.
3. The statement in the hypothesis should not be contradictory.
4. It should specify variables between which the relationship is to be established.
5. It should descried one issue only.

   A hypothesis can be formed either in descriptive or relational form. A hypothesis can also be formed in the directional, non directional or null form.

Characteristics of Hypothesis

- Hypothesis should be clear and precise.
- Should be capable of being tested. Research programmes have bogged down due to untestable hypothesis.
- Hypothesis state relationship between variables, if it be a relational Hypothesis.
- Should be limited in scope and must be specific. Narrower hypothesis are generally more testable and a researcher should developed such hypothesis.
- Hypothesis should be stated as possible in most simple terms so that it is easily understandable by all concern. But on must remember this simplicity of hypothesis has nothing to do with its significance.
- Hypothesis should be consistent with most known facts i.e., it must be a substantial body with the established facts.
- Should be amenable to testing within a reasonable time.
- Hypothesis must explain the facts that give rise to the need for explanation. Using the hypothesis and other known and accepted generalizations one should be able to explain the original problem Condition.

Types of Hypothesis

1. **Null Hypothesis**
2. **Alternative Hypothesis**

- **Null Hypothesis**

Hypothesis considering no difference or the hypothesis of no difference is called null hypothesis. Null hypothesis is reverse of research hypothesis. It is a hypothesis of no relationship. It is denoted by (Ho). Can include =, ≤ or ≥ sign in mathematical representation. We test the null hypothesis (statement) to accept or reject the alternative hypothesis.

- **Alternative Hypothesis**

Hypothesis which is substitute of null hypothesis is called alternative hypothesis. Alternative hypothesis is that which state opposite of the null hypothesis. It is denoted by (Ha).

Can include ≠, < or > in mathematical representation.

Null hypothesis is accepted when Alternative hypothesis is rejected. Null hypothesis is rejected when Alternative hypothesis is accepted.

In statistical test of null hypothesis, acceptance of Ho (null hypothesis) means rejection of the Alternative Hypothesis; and rejection of Ho means similarly acceptance of alternative hypothesis.

Suppose we want to test the hypothesis that the population mean (μ) is equal to the hypothesised mean (μ_{Ho}) =100.

Then null hypothesis is that the *population mean is equal to the hypothesised mean 100*

Symbolically it can be expressed as:

$$Ho: \mu = \mu_{Ho} = 100$$

If sample results do not support this null hypothesis, we should conclude that alternative hypothesis is true. Rejecting null hypothesis is known as alternative hypothesis.

For $Ho: \mu = \mu Ho = 100$, we may consider the alternative hypotheses as follows...

If our sample results do not support this null hypothesis, we should conclude that something else is true. What we conclude rejecting the null hypothesis is known as alternative hypothesis. In other words, the set of alternatives to the null hypothesis is referred to as the alternative hypothesis. If we accept H_0, then we are rejecting H_a and if we reject H_0, then we are accepting H_a. For $H_0 : \mu = \mu_{H_0} = 100$, we may consider three possible alternative hypotheses as follows*:

Table 9.1

Alternative hypothesis	*To be read as follows*
$H_a : \mu \neq \mu_{H_0}$	(The alternative hypothesis is that the population mean is not equal to 100 i.e., it may be more or less than 100)
$H_a : \mu > \mu_{H_0}$	(The alternative hypothesis is that the population mean is greater than 100)
$H_a : \mu < \mu_{H_0}$	(The alternative hypothesis is that the population mean is less than 100)

The null hypothesis and the alternative hypothesis are chosen before the sample is drawn (the researcher must avoid the error of deriving hypotheses from the data that he collects and then testing the hypotheses from the same data). In the choice of null hypothesis, the following considerations are usually kept in view:

(a) Alternative hypothesis is usually the one which one wishes to prove and the null hypothesis is the one which one wishes to disprove. Thus, a null hypothesis represents the hypothesis we are trying to reject, and alternative hypothesis represents all other possibilities.

(b) If the rejection of a certain hypothesis when it is actually true involves great risk, it is taken as null hypothesis because then the probability of rejecting it when it is true is α (the level of significance) which is chosen very small.

(c) Null hypothesis should always be specific hypothesis i.e., it should not state about or approximately a certain value.

Generally, in hypothesis testing we proceed on the basis of null hypothesis, keeping the alternative hypothesis in view. Why so? The answer is that on the assumption that null hypothesis is true, one can assign the probabilities to different possible sample results, but this cannot be done if we proceed with the alternative hypothesis. Hence the use of null hypothesis (at times also known as statistical hypothesis) is quite frequent.

(b) *The level of significance:* This is a very important concept in the context of hypothesis testing. It is always some percentage (usually 5%) which should be chosen wit great care, thought and reason. In case we take the significance level at 5 per cent, then this implies that H_0 will be rejected

*If a hypothesis is of the type $\mu = \mu_{H_0}$, then we call such a hypothesis as simple (or specific) hypothesis but if it is of the type $\mu \neq \mu_{H_0}$ or $\mu > \mu_{H_0}$ or $\mu < \mu_{H_0}$, then we call it a composite (or nonspecific) hypothesis.

The level of significance:

In a statistical test the probability of error in the result is called level of significance.

Level of significance 5% (0.05) indicates that there is the probability of 5% of error and probability of 95% to be correct. Ho (null hypothesis) will be rejected when the sampling result or calculated value is more than the tabulated value or critical value.

Type I and type II error

In context of hypothesis testing there are two types of errors we can make.

We may reject null hypothesis when it is true or we may accept null hypothesis when it is not true.

Type I error means rejection of hypothesis which should have been accepted. Type I error is denoted by (α)

Type II error means accepting of hypothesis which should have been rejected. Type II error is denoted by (β)

One Tail Test and Two Tail Test

The area within bell shape standard normal curve is considered to be 1. The acceptance or rejection of the null hypothesis that is the decision of statistical (significance) test depends on whether it is within the acceptance region or within the rejection region.

- **Two Tail Test**: When the test of hypothesis is made on the basis of the rejection region represented on both sides of the standard normal curve then it is called two tail test.
- **One Tail Test:** When the test of hypothesis is made on the basis of the rejection region represented on one side of the standard normal curve then it is called two tail test.

in such a situation one should prefer a Type I error to a Type II error. As a result one must set very high level for Type I error in one's testing technique of a given hypothesis.[2] Hence, in the testing of hypothesis, one must make all possible effort to strike an adequate balance between Type I and Type II errors.

(e) *Two-tailed and One-tailed tests:* In the context of hypothesis testing, these two terms are quite important and must be clearly understood. A two-tailed test rejects the null hypothesis if, say, the sample mean is significantly higher or lower than the hypothesised value of the mean of the population. Such a test is appropriate when the null hypothesis is some specified value and the alternative hypothesis is a value not equal to the specified value of the null hypothesis. Symbolically, the two-tailed test is appropriate when we have $H_0: \mu = \mu_{H_0}$ and $H_a: \mu \neq \mu_{H_0}$ which may mean $\mu > \mu_{H_0}$ or $\mu < \mu_{H_0}$. Thus, in a two-tailed test, there are two rejection regions*, one on each tail of the curve which can be illustrated as under:

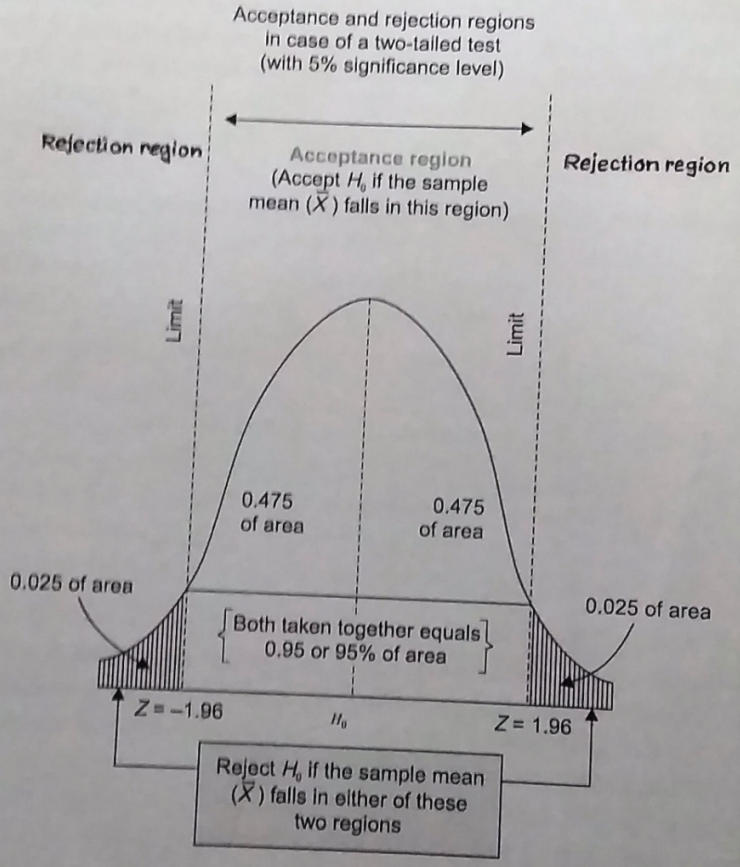

Fig. 9.1

[2] Richard I. Levin, *Statistics for Management*, p. 247–248.

*Also known as critical regions.

Mathematically we can state:

$$\textit{Acceptance Region } A : |Z| \leq 1.96$$

$$\textit{Rejection Region } R : |Z| \geq 1.96$$

If the significance level is 5 per cent and the two-tailed test is to be applied, the probability of the rejection area will be 0.05 (equally splitted on both tails of the curve as 0.025) and that of the acceptance region will be 0.95 as shown in the above curve. If we take $\mu = 100$ and if our sample mean deviates significantly from 100 in either direction, then we shall reject the null hypothesis; but if the sample mean does not deviate significantly from μ, in that case we shall accept the null hypothesis.

But there are situations when only one-tailed test is considered appropriate. A *one-tailed test* would be used when we are to test, say, whether the population mean is either lower than or higher than some hypothesised value. For instance, if our $H_0 : \mu = \mu_{H_0}$ and $H_a : \mu < \mu_{H_0}$, then we are interested in what is known as left-tailed test (wherein there is one rejection region only on the left tail) which can be illustrated as below:

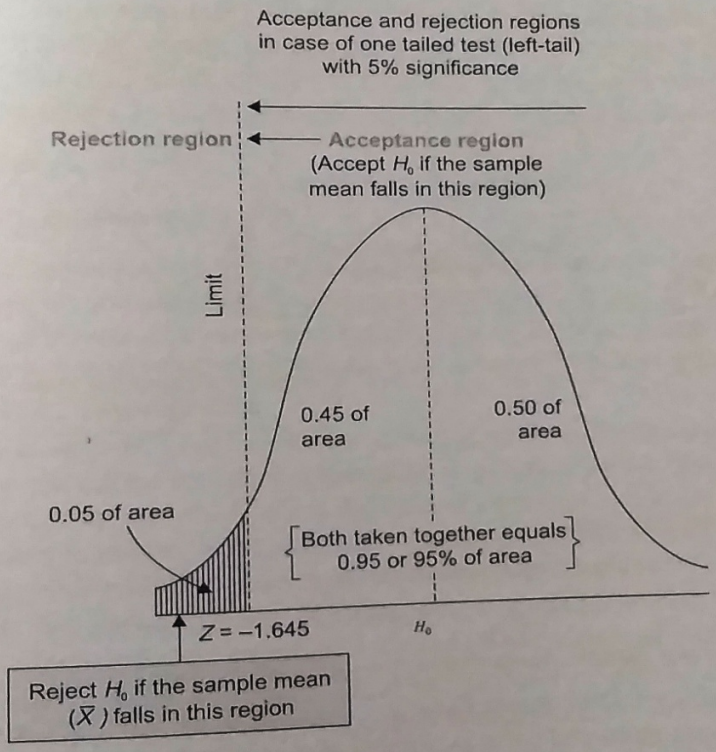

Fig. 9.2

Mathematically we can state:

$$\textit{Acceptance Region } A : Z > -1.645$$

$$\textit{Rejection Region } R : Z \leq -1.645$$

Flow Diagram for Hypothesis Testing

FLOW DIAGRAM FOR HYPOTHESIS TESTING

The above stated general procedure for hypothesis testing can also be depicted in the from of a flow chart for better understanding as shown in Fig. 9.4:[3]

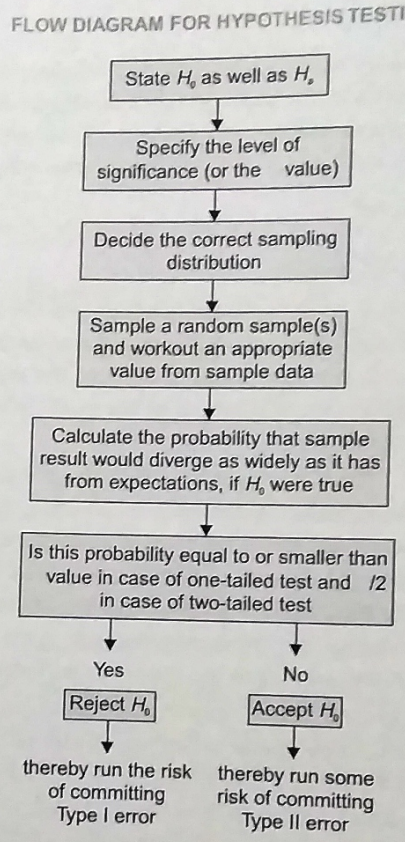

Fig. 9.4

[3] Based on the flow diagram in William A. Chance's *Statistical Methods for Decision Making*, Richard D. Irwin INC. Illinois, 1969, p.48.

Examples of the Null Hypothesis and alternative hypothesis

H_0: There is no difference in precipitation levels between urban and adjacent rural areas.

H_1: There is an increase in precipitation levels in urban areas relative to adjacent rural areas because of the heating differences of the two surface types (the urban area heats up more and has increased convective uplift).

Examples of the Null Hypothesis

To write a null hypothesis, first start by asking a question. Rephrase that question in a form that assumes no relationship between the variables. In other words, assume a treatment has no effect. Write your hypothesis in a way that reflects this.

Question	Null Hypothesis
Are teens better at math than adults?	Age has no effect on mathematical ability.
Does taking aspirin every day reduce the chance of having a heart attack?	Taking aspirin daily does not affect heart attack risk.
Do teens use cell phones to access the internet more than adults?	Age has no effect on how cell phones are used for internet access.
Do cats care about the color of their food?	Cats express no food preference based on color.

Reference:

Kothari, C.R.(2004). Research Methodology: Methods & Techniques. New Age International (p) Limited, New Delhi. Pp.184-192.

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